Introduction to Panel 4 Transport and mobility: How to deliver energy efficiency

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Introduction

The overall objective of this panel is to examine possibilities for transport to move in the direction of low carbon technologies and energy systems. Transportation is an area of activity which has seen rapid increase in energy demand and in which projected growth rates of activity and fossil fuel demand are high. The sector is made more complex by the combination of vehicle technologies with infrastructure which is expensive to construct and often very long lived. In passenger transport, urban mobility demand is closely linked to urban morphology as well as the provision of roads, public transport infrastructure and provision for cycling and walking. Personal travel decisions are not just made of cost and time grounds, but are also influenced by the prevailing car culture. Therefore, the goal of low carbon transport must be achieved through a combination of new vehicle technologies and interfaces with energy systems, realised through a mass diffusion of new travel behaviours and lifestyles. The panel considers the following areas: transport vehicle/energy system interactions, adoption of electric vehicles and alternative technologies, and aspects of changing demand and new lifestyles.

Low carbon transport and energy systems

Marnay et al. (4-056-13) consider the possibilities for PEVs to participate in grid services markets, a practice usually referred to as vehicle-to-grid (V2G) activities. The paper describes the technology and provides a deployment update of a mixed purpose and duty 40-vehicle 100 % PEV pilot test fleet at the Los Angeles Air Force Base. They find that a successful program may be able to generate about $100/month of revenue from these markets, which they consider significant. However, vehicles are not well suited for Regulation Energy Management designation in the markets because they must charge their batteries as well as provide regulation and the energy management system cannot properly manage charging when the entire fleet is not connected. The Non-REM designation may require a more careful management of a vehicle's state of charge in order to capture full capacity awards in regulation markets.

Gahleitner and Lindorfer (4-133-13) present the analysis of economic, technical and ecological aspects of alternative gaseous fuel production from renewable excess electricity. The 'power-to-gas' technology provides hydrogen by splitting water with excess electricity from renewable power sources or further synthesizes methane by using carbon dioxide. The case study for the supply of an Austrian public bus fleet with synthetic methane indicates that production costs are mainly influenced by the electricity price and the investment costs. They also strongly depend on the amount of full load hours per year of the power-to-gas facility. Currently, the synthetic methane production costs of €0.41/kWh are considerably higher than diesel prices. Given the future utilization of expected excess electricity from renewable power sources and a possible adaptation of the legal framework in the electricity sector the costs of synthetic methane production can possibly be reduced to approximately €0.13/kWh. Friis and Gram-Hanssen (4-153-13) considers the interplay between new smart grid technologies and households everyday practices. The research focuses on how Electric Vehicles (EVs) and Dynamic Pricing influence on Danish households' everyday life and how these technologies constitutes and change routines and practices of consumption in the everyday life of households. The case-study demonstrates that the smart grid technologies influence the 'way of driving' and changed the temporal patterns of consumption in the families during the test-period. The research shows how changes in

the elements 'technology' (EV) and 'institutional rules' (new electricity pricings) influence on the 'engagement-element' by increasing people's consciousness about their energy consumption that again influence on individual electricity use.

Gnann et al. (4-319-13) consider whether domestic charging infrastructure is sufficient to trigger market penetration of electric vehicles, or if public charging infrastructure is necessessary for mass market diffusion. Large data sets of German driving profiles are analysed to estimate the share of vehicles that could technically be operated as electric vehicles. In addition, the driving behaviour is combined with a simple market diffusion model for electric vehicles and their corresponding charging infrastructure where each user is assumed to choose the fuel option with the lowest total costs of ownership. The analysis does not justify a large development of public charging infrastructure and this is confirmed by empirical user behaviour data in pilot projects where not more than 10 % of all electricity for driving is charged publicly.

Haas and Ajanovic (4-096-13) investigate the perspectives of different alternative automotive technologies in a dynamic framework till 2050 in comparison to fossil fuel driven conventional cars from a technical, ecological and economic point-of-view. The technologies considered are: conventional and hybrid internal combustion engine, compressed natural gas-, flex-fuel-, battery electric- and fuel cell-vehicles. They project a combination of fuels, which can lead to a substantial decrease in energy losses. They find that by 2050 the total driving costs of all analysed fuels and powertrains could almost even out. The major uncertainty regarding battery electric- and fuel cell-vehicles is how fast technological learning will take place especially for the battery and the fuel cells. Schewel et al. (4-437-13) consider data collection for mobility management. They describe a longitudinal method to measure key transportation behavioural metrics over time, and thus evaluate the impact of efficiency measures that aim to reduce vehicle km in cities. They show how analysing archival (day old to years old) records from mobile telephone networks that include robust safeguards for personal information, may allow measurement of key transportation metrics in a manner that can be updated constantly with low marginal cost.

The adoption of electric vehicles

Vaggen Malvik et al. (4-102-13) present an analysis of the ongoing battery electric vehicles (BEV) revolution in Norway focusing on the measures that have been introduced to support a modal shift away from the classical motor car. Different policy measures, BEV infrastructure and EV technology developments and their coherence are examined. The paper also looks into the situation for BEV in some other European countries before lessons learned are drawn. A list of policies that needs to be in place before one could expect a BEV take-off in a given country is also presented. Norway has achieved a relatively successful growth pathway through a combination of fiscal policies and access benefits such as parking and access to bus lanes.

Globisch et al. (4-093-13) conduct a comparative analysis of commercial and private users of EVs and compare commercial users with a high acceptance of EVs to commercial users who have a lower acceptance for EVs. They surveyed a sample of long-term users of EVs which consisted of private and commercial users of electric passenger cars and transporters. EVs are rated overall very positively in the whole sample. Range restrictions and high costs seem to be the most salient barriers for user acceptance of EVs.

Wallis and Lane (4-514-13) synthesise the findings from existing studies on EVs and discuss opportunities for reducing the barriers to diffusion resulting from insufficient or misleading information. The paper focuses, in particular, on efforts in the UK to integrate information about electric vehicles into the colour-coded fuel economy label. The main finding from the testing of PHEV and REEV labels is that when only 'weighted combined' data is presented, few, if any car buyers, are able to understand either the terminology or the data. The two reasons for this lack of comprehension are the use of metric units, together with the difficulty of comprehending two energy sources simultaneously. The resulting experience is one of 'information overload'. The survey also highlights the potential of new technologies to positively disrupt current information channels such as the current paper-based Fuel Economy Label. For example, 'hard-links', such as provided by the increasingly ubiquitous QR Code, can be used to link a fuel economy label to a target website/URL (typically accessed on a smart phone or mobile device) where further information can be found.

The adoption of alternative technologies

Funke and Plötz (4-342-13) consider the potential for increased bicycle use the real potential for CO_2 mitigation and possible substitution rates (substitute car trips by bicycle trips) are not properly understood yet. They combine different statistical sources to estimate the potential of increased bicycle driving and the possible reduction of energy use in private transport and green house gas emissions. Using a large data set of German vehicle usage they analyse their driving behaviour in terms of the distribution of trip lengths, working trips and their weather dependence. The analysis shows that electric and non-electric two-wheelers have a significant potential to mitigate traffic and emissions in densely populated regions.

Plötz and Gnann (4-361-13) consider the early adopters of electric vehicles. They characterise the potential first users of electric vehicles from an economic perspective: Taking into account the costs of owning and driving an electric vehicle, which driving profiles make an electric vehicle cost-effective? Electric vehicles are typically more expensive in purchase but cheaper in usage, making them more attractive for intensive users. They analyse a large database of German driving profiles and find the share of potential first users from different city sizes and statuses of employment. They find the potential first users to be mostly full-time working and to live mainly in small to medium sized municipalities.

Sprei (4-196-13) looks at the adoption of flex-fuel vehicles in Sweden. Until 2008 the introduction of flex-fuel vehicles in the Swedish new vehicle market seemed to be a success. Each year sale shares increased, reaching in 2008 almost 25 % of the market. But since then the sales have dropped to 5 % of new sold cars in 2011. This paper explores both the rise and fall of this new technology. Sprei finds that changes in the rebate structure, coupled with variation in the media perception of benefits of ethanol are the major explanatory factors for the

development. The increased availability of a substitute, i.e., conventional vehicles that get labelled green by the official definition (less than 120 g CO_2/km) has also played a role.

Lifestyles and demand

Ajanovic (4-092-13) analyses the change of energy consumption of passenger cars along the energy service (mobility) providing chain (well-to wheel) of different car types cars (diesel-, gasoline-, natural gas-, battery electric- and fuel cell vehicles) with special focus on the impact of the size of new cars. There are considerable differences between biofuels as well as electricity and hydrogen produced from renewable and fossil energy sources. Power-specific fuel intensity decreased by more than 40 % since 1990, i.e. efficiency in 2010 was much higher than in 1990. However, about half of these theoretically possible energy savings have been compensated by the switch to larger cars and virtually the same effect can be seen for specific CO_2 emissions. This leads to the final conclusion that future energy policy has to address the size issue e.g. by means of size-dependent registration taxes.

Bartiaux (4-304-13) asks how committed drivers can move away from the 'system of automobility'. Under what conditions is this possible and what is the importance of contextual factors, such as regional mobility policies? Which relevance do the social theories of practice have for studying this phenomenon? Interviews were undertaken in 2012 in Belgium with persons having driven a car for at least ten years and presenting themselves as having quit this habit and sold their car. Results indicate the importance of a good and efficient public-transportation system, the effectiveness of certain policy instruments and, in conjunction, the availability of at least one close relative (the spouse, a parent …) who has a car and helps the interviewee get rid of his/her car without being excluded from the 'system of automobility'.

Pridmore and Anable (4-509-13) consider the role of neighbourhood and peer influence on the purchase of a new vehicle technology – hybrid cars. Exploratory Spatial Data Analysis techniques examine consumer take up of these technologies in London, spatially and temporally. Clusters of ownership were detected and informed the choice of case study areas for pilot qualitative interviews. It suggested that social influence was present in vehicle purchase decisions whether through a neighbour checking the suitability of the vehicle or the respondent seeking advice from a friend.